TRANSLATION

I, Yuko Mitsui, residing at 4-6-10, Higashikoigakubo, Kokubunji-shi, Tokyo, Japan, state:

that I know well both the Japanese and English languages,

that I translated, from Japanese into English, Japanese Patent Application No. 2002-368012, filed on December 19, 2002, and

that the attached English translation is a true and accurate translation to the best of my knowledge and belief.

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Yuko Mitui

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[Title of the Invention] VACUUM PROCESSING APPARATUS AND EXHAUST RING

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[Document] Description

[Title of the Invention] VACUUM PROCESSING APPARATUS AND EXHAUST RING

[Claims]

[Claim 1]

A vacuum processing apparatus comprising:

a vacuum processing chamber;

a mounting stand which is disposed in the vacuum processing chamber, and on which a substrate to be processed is mounted;

an exhaust mechanism which exhausts an inside of the vacuum processing chamber from a lower side of the mounting stand; and

an exhaust ring which is formed in an annular shape so as to surround a circumference of the mounting stand, and at which a plurality of exhaust holes are provided, characterized in that

the exhaust ring has plural types of the exhaust holes with different opening areas, and the exhaust holes are arranged such that opening areas of the exhaust holes arranged at an outer circumferential part of the exhaust ring are made greater than opening areas of the exhaust holes arranged at an inner circumferential part of the exhaust ring.

[Claim 2]

The vacuum processing apparatus according to claim 1, characterized in that

at least three or more types of the exhaust holes with different opening areas are arranged at the exhaust ring such that the opening areas of the exhaust holes are made gradually

greater from the inner circumferential part to the outer circumferential part of the exhaust ring.

[Claim 3]

The vacuum processing apparatus according to claim 1 or 2, characterized in that

the exhaust ring is made to have a board thickness which differs in a phased manner concentrically in accordance with the opening areas of the exhaust holes.

[Claim 4]

The vacuum processing apparatus according to any one of claims 1 to 3, characterized in that

magnets to prevent leakage of plasma generated in the vacuum processing chamber are provided to the exhaust ring.

[Claim 5]

The vacuum processing apparatus according to claim 4, characterized in that

the magnets are arranged such that magnetic poles are along a circumferential direction of the exhaust ring, and a plurality of the magnets are arranged at even intervals along the circumferential direction.

[Claim 6]

The vacuum processing apparatus according to any one of claims 1 to 5, characterized in that

the exhaust holes are formed from circular holes, and a diameter of the exhaust holes with the largest opening area which are arranged at an outermost circumferential part is made to be 5 to 20 mm.

[Claim 7]

The vacuum processing apparatus according to any one of claims 1 to 6, characterized in that

etching processing is applied onto the substrate to be processed by generating plasma in the vacuum processing chamber.

[Claim 8]

An exhaust ring which is formed in an annular shape so as to surround a circumference of a mounting stand which is disposed in a vacuum processing chamber in a vacuum processing apparatus, and on which a substrate to be processed is mounted, and at which a plurality of exhaust holes are provided, the exhaust ring comprising

plural types of the exhaust holes with different opening areas, characterized in that

the exhaust holes are arranged such that opening areas of the exhaust holes arranged at an outer circumferential part are made greater than opening areas of the exhaust holes arranged at an inner circumferential part.

[Claim 9]

The exhaust ring according to claim 8, characterized in that

at least three or more types of the exhaust holes with different opening areas are arranged such that the opening areas of the exhaust holes are made gradually greater from the inner circumferential part to the outer circumferential part.

[Claim 10]

The exhaust ring according to claim 8 or 9, characterized

in that

the exhaust ring is made to have a board thickness which differs in a phased manner concentrically in accordance with the opening areas of the exhaust holes.

[Claim 11]

The exhaust ring according to any one of claims 8 to 10, characterized in that

magnets to prevent leakage of plasma generated in the vacuum processing chamber are provided.

[Claim 12]

The exhaust ring according to claim 11, characterized in that

the magnets are disposed such that magnetic poles are along a circumferential direction of the exhaust ring, and a plurality of the magnets are disposed at even intervals along the circumferential direction.

[Claim 13]

The exhaust ring according to any one of claims 8 to 12, characterized in that

the exhaust holes are formed from circular holes, and a diameter of the exhaust holes with the largest opening area which are arranged at an outermost circumferential part is made to be 5 to 20 mm.

[Detailed Description of the Invention]

[0001]

[Technical Field]

The present invention relates to a vacuum processing

apparatus which applies predetermined vacuum processing such as plasma etching processing or the like onto a substrate to be processed such as a semiconductor wafer or the like, and to an exhaust ring thereof.

[0002]

[Background Art]

Conventionally, in manufacturing processes for semiconductor devices and LCDs, vacuum processing apparatuses which apply predetermined processing, for example, deposition processing, etching processing, or the like, onto a substrate to be processed such as a semiconductor wafer, an LCD substrate, or the like under vacuum atmosphere, have been in heavy usage.

[0003]

Among such vacuum processing apparatuses, for example, in a parallel plate type plasma etching apparatus, a mounting stand (suscepter) serving as a lower electrode as well is provided in a vacuum processing chamber (plasma processing chamber), and a so-called shower head functioning as an upper electrode is provided above the mounting stand.

[0004]

Then, the plasma etching apparatus is structured such that a predetermined process gas supplied in a shower form from the shower head is made to be plasma by high-frequency power applied between the mounting stand and the shower head, and plasma etching processing is carried out by applying the plasma onto the substrate to be processed mounted on the mounting stand.

[0005]

Further, in the plasma etching apparatus described above, an exhaust mechanism is provided in order for the inside of the plasma processing chamber to be exhausted so as to be a predetermined degree of vacuum suitable for plasma etching processing. In such an exhaust mechanism, as a structure in which it is possible to form a uniform flow of process gas as much as possible around the substrate to be processed mounted on the mounting stand, it is necessary to improve the uniformity of processing in the plane of the substrate to be processed.

[0006]

Therefore, an apparatus has been known which is structured such that an annular exhaust ring having many exhaust holes is disposed at the circumference of the mounting stand, and exhaust is carried out from the lower side of the exhaust ring (for example, refer to Pat. Document 1).

[0007]

Further, in the plasma etching apparatus, leakage of plasma from the plasma processing chamber is prevented by the exhaust ring described above, and therefore, a diameter of an exhaust hole is made to be a relatively small diameter of, for example, 1.5 mm or the like.

[0008]

Then, for example, as shown in FIG. 6, an exhaust ring 101 is structured by a large number (for example, ten thousands or more) of exhaust holes 100 formed from fine pores having the same diameter in a size as described above being arranged radially at an annular plate material.

[0009]

[Pat. Document 1] Jpn. Pat. Appln. KOKAI Publication No. 7-245295 (on fifth to sixth pages, in FIGS. 1 to 2)

[0010]

[Problem to Be Solved]

As described above, conventionally, in a vacuum processing apparatus such as a plasma etching apparatus or the like, an attempt is made to uniform a flow of process gas by disposing an annular exhaust ring at a circumference of a mounting stand. Further, it has been carried out that leakage of plasma from a plasma processing chamber is prevented by such an exhaust ring.

[0011]

However, because exhaust efficiency is lowered by use of such an exhaust ring, it has been further desired that an attempt is made to enhance the exhaust efficiency by improving the conductance of the exhaust ring.

[0012]

The present invention has been achieved in consideration of such conventional circumstances, and an object of the present invention is to provide a vacuum processing apparatus in which it is possible to improve the conductance of an exhaust ring as compared with a prior art, and in accordance therewith, an attempt can be made to enhance the exhaust efficiency, and to provide an exhaust ring.

[0013]

[Means for Solving the Problem]

The invention of claim 1 is a vacuum processing apparatus

comprising: a vacuum processing chamber; a mounting stand which is disposed in the vacuum processing chamber, and on which a substrate to be processed is mounted; an exhaust mechanism which exhausts an inside of the vacuum processing chamber from a lower side of the mounting stand; and an exhaust ring which is formed in an annular shape so as to surround a circumference of the mounting stand, and at which a plurality of exhaust holes are provided, characterized in that the exhaust ring has plural types of the exhaust holes with different opening areas, and the exhaust holes are arranged such that opening areas of the exhaust holes arranged at an outer circumferential part of the exhaust ring are made greater than opening areas of the exhaust holes arranged at an inner circumferential part of the exhaust ring.

[0014]

The invention of claim 2 is the vacuum processing apparatus according to claim 1, characterized in that at least three or more types of the exhaust holes with different opening areas are arranged at the exhaust ring such that the opening areas of the exhaust holes are made gradually greater from the inner circumferential part to the outer circumferential part of the exhaust ring.

[0015]

The invention of claim 3 is the vacuum processing apparatus according to claim 1 or 2, characterized in that the exhaust ring is made to have a board thickness which differs in a phased manner concentrically in accordance with the opening areas of the exhaust holes.

[0016]

The invention of claim 4 is the vacuum processing apparatus according to any one of claims 1 to 3, characterized in that magnets to prevent leakage of plasma generated in the vacuum processing chamber are provided to the exhaust ring.

[0017]

The invention of claim 5 is the vacuum processing apparatus according to claim 4, characterized in that the magnets are arranged such that magnetic poles are along a circumferential direction of the exhaust ring, and a plurality of the magnets are arranged at even intervals along the circumferential direction.

[0018]

The invention of claim 6 is the vacuum processing apparatus according to any one of claims 1 to 5, characterized in that the exhaust holes are formed from circular holes, and a diameter of the exhaust holes with the largest opening area which are arranged at an outermost circumferential part is made to be 5 to 20 mm.

[0019]

The invention of claim 7 is the vacuum processing apparatus according to any one of claims 1 to 6, characterized in that etching processing is applied onto the substrate to be processed by generating plasma in the vacuum processing chamber.

[0020]

The invention of claim 8 is an exhaust ring which is formed in an annular shape so as to surround a circumference of a mounting

standwhich is disposed in a vacuum processing chamber in a vacuum processing apparatus, and on which a substrate to be processed is mounted, and at which a plurality of exhaust holes are provided, the exhaust ring comprising plural types of the exhaust holes with different opening areas, characterized in that the exhaust holes are arranged such that opening areas of the exhaust holes arranged at an outer circumferential part are made greater than opening areas of the exhaust holes arranged at an inner circumferential part.

[0021]

The invention of claim 9 is the exhaust ring according to claim 8, characterized in that at least three or more types of the exhaust holes with different opening areas are arranged such that the opening areas of the exhaust holes are made gradually greater from the inner circumferential part to the outer circumferential part.

[0022]

The invention of claim 10 is the exhaust ring according to claim 8 or 9, characterized in that the exhaust ring is made to have a board thickness which differs in a phased manner concentrically in accordance with the opening areas of the exhaust holes.

[0023]

The invention of claim 11 is the exhaust ring according to any one of claims 8 to 10, characterized in that magnets to prevent leakage of plasma generated in the vacuum processing chamber are provided.

[0024]

The invention of claim 12 is the exhaust ring according to claim 11, characterized in that the magnets are disposed such that magnetic poles are along a circumferential direction of the exhaust ring, and a plurality of the magnets are disposed at even intervals along the circumferential direction.

[0025]

The invention of claim 13 is the exhaust ring according to any one of claims 8 to 12, characterized in that the exhaust holes are formed from circular holes, and a diameter of the exhaust holes with the largest opening area which are arranged at an outermost circumferential part is made to be 5 to 20 mm.

[0026]

[Description of the Preferred Embodiment]

Hereinafter, details of the present invention will be described with respect to an embodiment with reference to the drawings.

[0027]

FIG. 1 typically shows a schematic structure of an entire vacuum processing apparatus (plasma etching apparatus) according to an embodiment of the present invention. In the drawing, reference numeral 1 denotes a cylindrical processing chamber which is formed from, for example, aluminum in which anodic oxide coating (alumite) is formed on the surface, or the like, as a material, and is structured such that the interior portion is able to be closed in an airtight manner, and which structures a vacuum processing chamber (plasma processing

chamber).

[0028]

The above-described processing chamber 1 is connected to a ground potential, and a mounting stand (suscepter) 2 which is structured in a substantial disk shape from, for example, aluminum in which anodic oxide coating (alumite) is formed on the surface, as a material, and which serves as a lower electrode as well is provided in the interior portion of the processing chamber 1.

[0029]

An electrostatic chuck 3 is provided on a plane of the mounting stand 2 on which a semiconductor wafer W is mounted. The electrostatic chuck 3 is structured such that an electrostatic chuck electrode 3a is set in an insulating film 3b formed from, for example, an insulating material such as polyimide or the like.

[0030]

The above-described mounting stand 2 is supported in the vacuum chamber 1 via an insulating plate 4 of ceramic or the like, and a direct-current power source 5 is connected to the electrostatic chuck electrode 3a of the electrostatic chuck 3.

[0031]

Further, a focus ring 6 which is formed in an annular shape so as to surround the circumference of the semiconductor wafer W is provided on the mounting stand 2.

[0032]

Further, in the interior portion of the mounting stand

2, a heating medium channel 7 for circulating insulating fluid serving as a heating medium for temperature control, and a gas passageway 8 for supplying a gas for temperature control such as a helium gas or the like to the rear face of the semiconductor wafer W are provided.

[0033]

Then, the mounting stand 2 is controlled so as to be at a predetermined temperature by circulating the insulating fluid controlled to be at a predetermined temperature in the heating medium channel 7, and a gas for temperature control is supplied between the mounting stand 2 and the semiconductor wafer W via the gas passageway 8, which speeds up heat exchange therebetween, and therefore, it is possible to control the semiconductor wafer W to be at a predetermined temperature with high accuracy and efficiently.

[0034]

Further, a feeder line 10 for supplying high-frequency power is connected to substantially a center of the mounting stand 2. A high-frequency power source (RF power source) 12 is connected to the feeder line 10 via a matching box 11, and high-frequency power at a predetermined frequency is supplied from the high-frequency power source 12.

[0035]

Further, the exhaust ring 13 formed in an annular shape is provided at the outside of the focus ring 6 described above. At this exhaust ring 13, as shown in FIG. 2 as well, plural types (three types in the present embodiment) of exhaust holes 14a,

14b, and 14c with different opening areas are formed, and these exhaust holes 14a, 14b and 14c are arranged such that the opening areas are made gradually greater as those are located outward from the exhaust holes 14a provided at the inner part of the exhaust ring 13, to the exhaust holes 14b provided at the intermediate part and the exhaust holes 14c provided at the outermost circumferential part. Note that, in the present embodiment, the exhaust holes 14a, 14b and 14c are structured from circular holes, and the sizes of the opening areas are the same as the sizes of the diameters of the circular holes.

[0036]

As described above, by providing plural types of the exhaust holes 14a, 14b, and 14c with different opening areas to the exhaust ring 13 such that the opening areas (the diameters of the circular holes) are made gradually greater as those are located outward, it is possible to make more efficient use of a space among the exhaust holes as compared with a case in which the exhaust holes 100 with the same opening area, i.e., the same diameter are arranged as the conventional exhaust ring 101 shown in FIG. 6.

[0037]

Namely, as shown in FIG. 6, when the exhaust holes 100 with the same diameter are arranged linearly along the radial direction, intervals among the exhaust holes 100 adjacent to one another radially at the outer circumferential part are made to broaden, which makes a wasted space (dead space) larger from the standpoint of exhaust efficiency. In contrast thereto, as

shown in FIG. 2, provided that the exhaust holes 14a, 14b, and 14c with different opening areas are arranged such that the opening areas (the diameters of the circular holes) are made gradually greater as those are located outward, there is no case in which an interval between the exhaust holes 14c and 14c adjacent to one another radially is made to broaden, which makes it possible to make effective use of a space on the exhaust ring 13.

[0038]

In accordance therewith, an opening area as the entire exhaust ring 13 can be made greater, which increases conductance of the exhaust ring 13 as a whole, and it is possible to enhance the exhaust efficiency.

[0039]

Note that, provided that the diameters of the above-described exhaust holes 14a, 14b, and 14c are made greater, it is possible to increase the conductance. However, when the diameters of the exhaust holes 14a, 14b, and 14c are made too large, the possibility that plasma leaks to the lower side of the exhaust ring 13 is increased. Further, such leakage of plasma can be prevented if a board thickness of the exhaust ring 13 is made thicker to some extent. However, when a board thickness of the exhaust ring 13 is made thicker, the conductance is lowered.

[0040]

Then, as a result of determining a relationship between the conductance and the performance for preventing leakage of plasma by a calculation while changing the diameters of the exhaust holes 14a, 14b, and 14c as described above, and a board

thickness of the exhaust ring 13, the sizes of the exhaust holes 14a, 14b, and 14c are preferably set such that the diameters of the exhaust holes 14c with the largest opening area at the outermost circumferential part are made to be, for example, about 5 to 20 mm. In this case, as described above, when a board thickness of the exhaust ring 13 is too thin, the possibility that plasma leaks to the lower side of the exhaust ring 13 through the exhaust holes 14c described above or the like is increased. Therefore, a board thickness of the exhaust ring 13 is preferably made to be about 5 to 20 mm.

[0041]

For example, when a diameter of the exhaust hole 14c with the largest opening area at the outermost circumferential part is made to be 10 mm, and a board thickness of the exhaust ring 13 is made to be 15 mm, the conductance can be made double or more as much as that of the exhaust ring 101 shown in FIG. 6 (a diameter of the exhaust hole 100 is 1.5 mm, and a board thickness is 2 mm), and it is possible to improve the performance for preventing leakage of plasma.

[0042]

Note that, as described above, because the opening areas of the exhaust holes 14a, 14b, and 14c are respectively different, a board thickness of the exhaust ring 13 required for preventing leakage of plasma respectively differs for each of the exhaust holes 14a, 14b, and 14c. Namely, for example, with respect to the exhaust hole 14a with a relatively small opening area, a board thickness of the exhaust ring 13 required for preventing

leakage of plasma is made thinner than that of the exhaust hole 14c or the like with a larger opening area.

[0043]

Therefore, this can be structured such that a thickness of the exhaust ring 13 varies in a phased manner so as to be an appropriate thickness in accordance with each portion of the exhaust holes 14a, 14b, and 14c as shown in FIG. 3. In accordance with such a structure, it is possible to further improve the conductance of the exhaust ring 13 while preventing leakage of plasma, and an attempt can be made to enhance the exhaust efficiency.

[0044]

Further, in order to prevent leakage of plasma, it is effective that, for example, as shown in FIG. 4, a plurality of (twelve in an example shown in FIG. 4) magnets 50 are arranged at predetermined intervals (at intervals of 30° in the example shown in FIG. 4) at the exhaust ring 13, which makes a magnetic field in the vicinity of the exhaust ring 13. Note that, as directions of magnetic poles are shown by arrows in FIG. 4, the magnetic poles of the magnets 50 are arranged along the circumferential direction of the exhaust ring 13.

[0045]

In this way, the orbit of charged particles in the plasma is turned by forming a magnetic field in the vicinity of the exhaust ring 13, and the charged particles are bombarded with the inner wall portion of the exhaust ring 13 in the exhaust holes 14a, 14b, and 14c, which makes it possible to prevent leakage

of plasma.

[0046]

When such a structure is used, as shown in FIG. 4, because a space at which the magnets 50 are arranged is required, the number of the exhaust holes 14a, 14b, and 14c which can be provided at the exhaust ring 13 is reduced as compared with a case in which the magnets 50 are not provided.

[0047]

However, when the magnets 50 are provided, a board thickness of the exhaust ring 13 which is required for preventing leakage of plasma can be thinner than that in a case in which the magnets 50 are not provided. Therefore, as a whole, it is possible to improve the conductance of the exhaust ring 13 more than the case in which the magnets 50 are not provided, and it is possible to enhance the exhaust efficiency.

[0048]

Further, in the exhaust rings 13 shown in FIGS. 2 and 4, the exhaust holes 14a, 14b, and 14c are arranged linearly along the radial direction. However, for example, as shown in FIG. 5, the exhaust holes 14a, 14b, and 14c may be arranged, not linearly, but in zigzag by being shifted in the circumferential direction. Provided that such a structure is used, it is possible to reduce a wasted space (dead space) on the exhaust ring 13.

[0049]

Note that, in the exhaust rings 13 shown in FIGS. 2, 4, and 5, the exhaust holes 14a, 14b, and 14c are structured from circular holes. However, the shapes of the exhaust holes 14a,

14b, and 14c are not limited to a circular form, and may be, another shape such as, for example, a polygon or the like.

[0050]

An exhaust port 15 is provided under the exhaust ring 13 in the above-described structure, and this is structured such that evacuation of the processing space in the processing chamber 1 is carried out via the exhaust ring 13 by a vacuum pump or the like of an exhaust system 16 connected to the exhaust port 15.

[0051]

On the other hand, the shower head 17 is provided so as to face in parallel with the mounting stand 2 at the ceiling portion of the processing chamber 1 of the mounting stand 2, and the shower head 17 is grounded. Accordingly, these mounting stand 2 and shower head 17 function as a pair of electrodes (an upper electrode and a lower electrode).

[0052]

With respect to the above-described shower head 17, many gas discharge holes 18 are provided at the bottom face thereof, and additionally, a gas inlet portion 19 is provided above those. Then, a gas diffusion airspace 20 is formed in the interior portion thereof. A gas supply piping 21 is connected to the gas inlet portion 19, and a gas supply system 22 is connected to the other end of the gas supply piping 21. This gas supply system 22 is structured from a mass flow controller (MFC) 23 for controlling a gas flow rate, and a process gas supply source 24 for supplying, for example, a process gas for etching or the like.

[0053]

On the other hand, an annular magnetic field forming mechanism (ring magnet) 25 is disposed concentrically with the processing chamber 1 around the outside of the processing chamber 1, which forms a magnetic field in the processing space between the mounting stand 2 and the shower head 17. The entire magnetic field forming mechanism 25 is made to be rotatable at a predetermined rotational speed around the processing chamber 1 by a rotating mechanism 26.

[0054]

Next, a procedure of plasma etching processing by the plasma etching apparatus structured as described above will be described.

[0055]

First, an unillustrated gate valve provided to the processing chamber 1 is opened, and the semiconductor wafer W is carried into the processing chamber 1 by a carrying mechanism (not shown) via a load lock chamber (not shown) disposed so as to be adjacent to the gate valve, and is mounted on the mounting stand 2.

[0056]

Then, after the carrying mechanism is evacuated to the outside of the processing chamber 1, the gate valve 1 is closed. Further, the semiconductor wafer W is adsorbed to be held by applying a direct-current voltage at a predetermined voltage from the direct-current power source 5 to the electrostatic chuck electrode 3a of the electrostatic chuck 3.

[0057]

Thereafter, while the processing space in the processing chamber 1 is exhausted to be at a predetermined degree of vacuum, for example, 1.33 Pa to 133 Pa via the exhaust ring 13 described above by the vacuum pump of the exhaust system 16, a predetermined process gas is supplied to the processing chamber 1 from the process gas supply system 22.

[0058]

Then, in this state, plasma is generated in the space between the mounting stand 2 and the shower head 17 by applying a high frequency at a predetermined frequency, for example, over ten MHz to a hundred and several tens of MHz to the mounting stand 2 via the matching box 11 from the high-frequency power source 12, and etching onto the semiconductor wafer W by plasma is carried out.

[0059]

During this etching processing, by exhausting the air of the processing space in the processing chamber 1 via the exhaust ring 13, the exhaust air is carried out uniformly from the circumference of the semiconductor wafer W mounted on the mounting stand 2, and a uniform flow of process gas is formed at the circumference of the semiconductor wafer W, which makes it possible to apply uniform processing with high in-plane uniformity over the entire surface of the semiconductor wafer W. Further, because the conductance of the exhaust ring 13 is high, the exhaust efficiency is enhanced, which makes it possible to apply favorable processing at a desired degree of vacuum,

and to prevent leakage of plasma.

[0060]

Then, when predetermined etching processing is executed onto the semiconductor wafer W, the plasma etching processing is stopped by stopping the supply of high-frequency power from the high-frequency power source 12, and the semiconductor wafer W is carried to the outside of the processing chamber 1 following a procedure opposite to the procedure described above.

[0061]

Note that, in the embodiment described above, the case in which the present invention is applied to the plasma etching apparatus which applies plasma-etching processing onto the semiconductor wafer W has been described. However, the present invention is not limited to such an embodiment, and can be applied to every vacuum processing apparatus such as, for example, a deposition apparatus or the like. Further, it goes without saying that a substrate to be processes is not limited to the semiconductor wafer W, and the present invention can be applied to, for example, vacuum processing onto an LCD substrate, or the like in the same way.

[0062]

[Advantage of the Invention]

As described above in detail, in accordance with the vacuum processing apparatus and the exhaust ring of the present invention, it is possible to improve the conductance of the exhaust ring as compared with the conventional art, and an attempt can be made to enhance the exhaust efficiency.

[Brief Description of Drawings]

FIG. 1 is a diagram showing an entire schematic structure of a vacuum processing apparatus of one embodiment of the present invention.

FIG. 2 is a diagram showing a schematic structure of a substantial part of the vacuum processing apparatus of FIG. 1.

FIG. 3 is a diagram showing a modified example of the schematic structure of the substantial part of the vacuum processing apparatus of FIG. 1.

FIG. 4 is a diagram showing a modified example of the schematic structure of the substantial part of the vacuum processing apparatus of FIG. 1.

FIG. 5 is a diagram showing a modified example of the schematic structure of the substantial part of the vacuum processing apparatus of FIG. 1.

FIG. 6 is a diagram showing a schematic structure of a substantial part of a conventional vacuum processing apparatus.

[Explanation of Reference Symbols]

W Semiconductor wafer

1 Processing chamber

2 Mounting stand

3 Electrostatic chuck

13 Exhaust ring

14a, 14b, 14c Exhaust holes

15 Exhaust port

16 Exhaust system

PROCESS GAS SUPPLY SOURCE

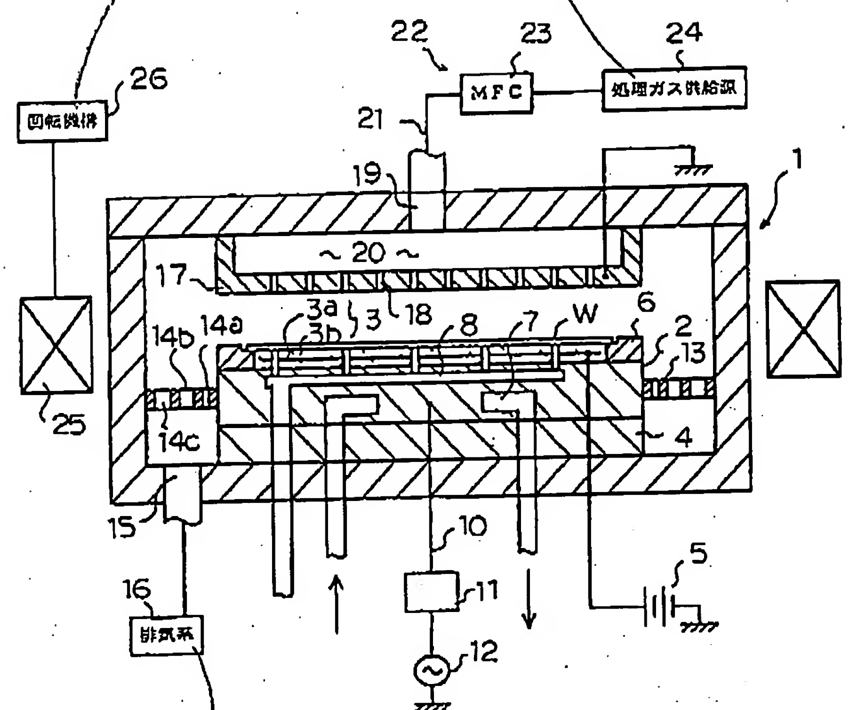

FIG. 1

EXHAUST SYSTEM

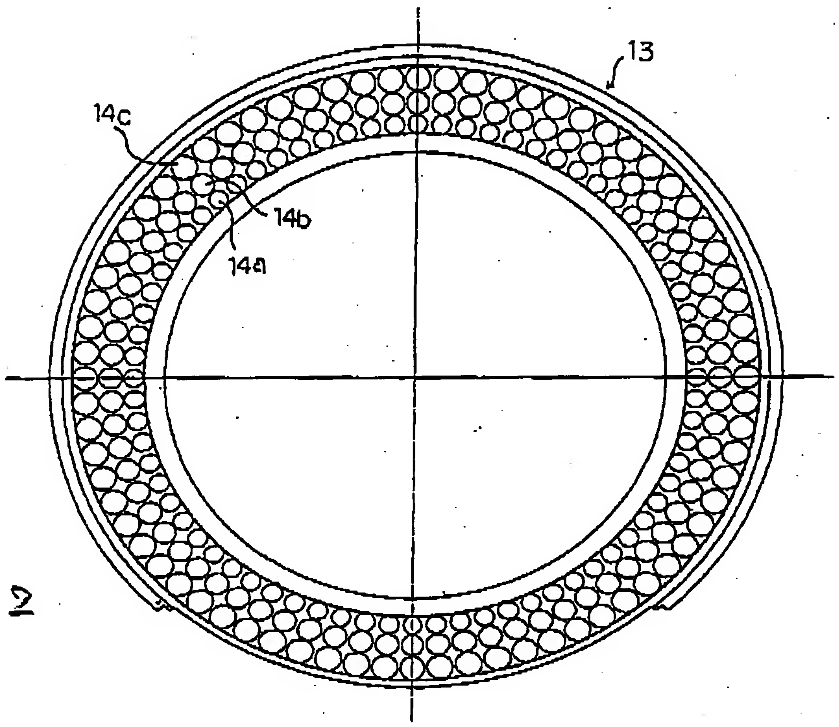

FIG. 2

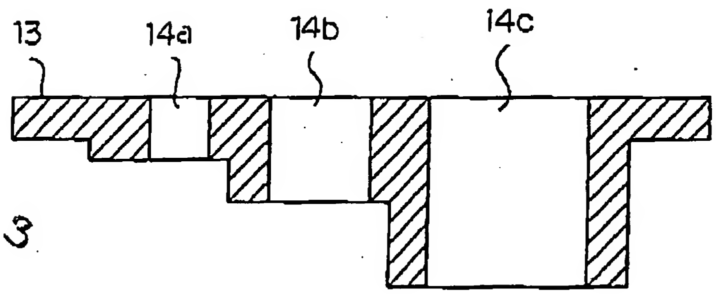

FIG. 3

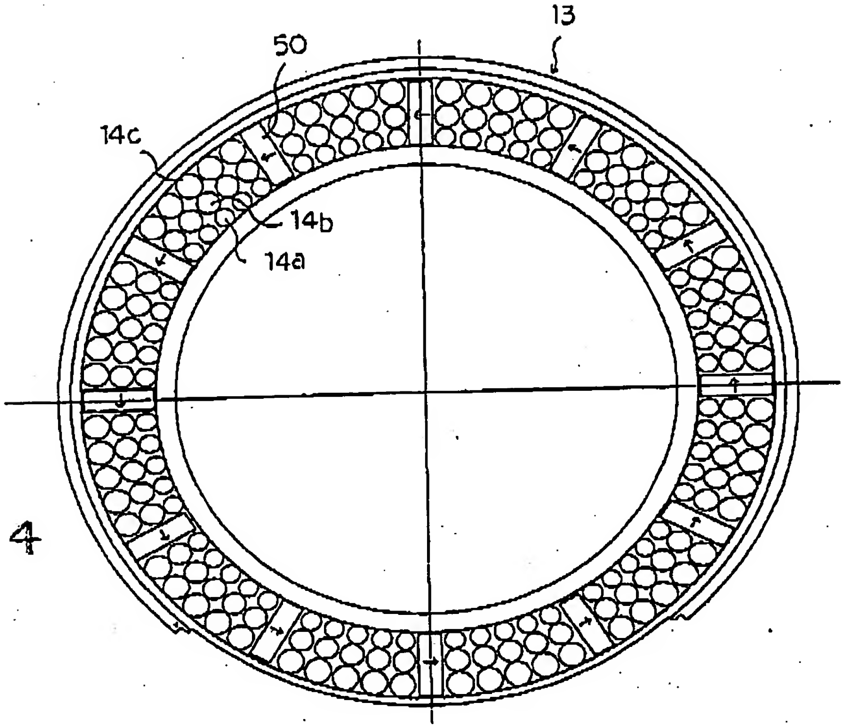

FIG. 4

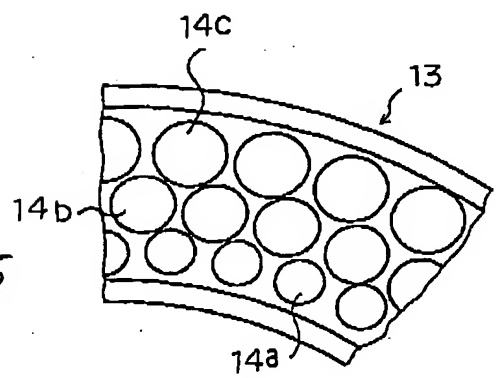

FIG. 5

[Document] Abstract

[Abstract]

[Problem]

To provide a vacuum processing apparatus in which it is possible to improve conductance of an exhaust ring, and an attempt can be made to enhance the exhaust efficiency as compared with a conventional art, and provide an exhaust ring.

[Means for Solving the Problem]

An exhaust ring 13 structured in an annular shape is provided at a circumference of a mounting stand 2 on which a semiconductor wafer W is mounted. Plural types of exhaust holes 14a, 14b, and 14c with different opening areas are formed at the exhaust ring 13, and these exhaust holes 14a, 14b, and 14c are arranged such that the opening areas (diameters of the holes) are made greater as those are located outward from the exhaust holes 14a provided at an inner part of the exhaust ring 13 to the exhaust holes 14b provided at an intermediate part and the exhaust holes 14c provided at an outermost circumferential part.

[Elected Figure] FIG. 1